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ABSTRACT

Based in a stream of community-based health promotion activities rather than a fixed framework of hypothesis testing, the study described in this paper tried to solve the problem of the one-sided communication between Japanese health care providers and receivers by visualizing health-related feelings and concepts for both parties involved in the communication. Three visualization prototypes were developed to visualize: (1) basic sensation and feelings accompanying illness using symptomatic symbols; (2) a wholistic concept of wellness using a face graph; and (3) the multidimensionality of health by using two-dimensional mapping. To develop and further improve these prototypes, people's needs were considered and the research strategy of learning from people by sharing the process of problem solving was adopted. The prototypes were announced at various professional meetings, and people were invited to participate in the process of problem-solving. Several groups were interested and assisted by improvement and triangulation of the prototypes. Results indicated that the strategy was effective in improving the understanding of health-related concerns in typical situations. (Two tables of data and 12 figures are included; 24 references are attached.) (RS)

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Use of Visual Symbols to Promote Communication Between Health Care Providers and Receivers

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Use of Visual Symbols to Promote Communication Between Health Care Providers and Receivers

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ABSTRACT

With the aging population in Japan, an increasing number of people place a higher value on health. For the adults, encounters with health-care providers are expected to be opportunities to learn about health. However, the one-sidedness of the communication at the encounter prevents both health-care providers and receivers from getting meaningful interactive feedback. In this study, we tried to solve the problem of one-sided communication by visualizing health-related feelings and concepts for both parties involved in the communication. Three visualization prototypes were developed to (a) visualize basic sensation and feelings accompanying illness using symptomatic symbols, (b) visualize a wholistic concept of wellness using a face graph, and (c) visualize multidimensionality of health by using two-dimensional mapping. To develop and further improve these prototypes, we considered the people's needs and adopted the research strategy of learning from people by sharing the process of problem solving . Three prototypes were announced at various professional meetings, and people were invited to participate in the process of problem-solving. Several groups were interested in this project and assisted by improvement and triangulation of the prototypes. The results indicated that the strategy was effective in improving the understanding of health-related concerns in typical situations.

Use of Visual Symbols to Promote Communication Between Health Care Providers and Receivers

INTRODUCTION

In Japan, the elderly population (65 years and over) represented 11.6% of the total population in 1989, and the percentage is estimated to increase to 21.1% in the year 2010 (Health and Welfare Statistics Association, 1989.) Due to this rapid aging trend, increasing numbers of people place a higher value on health. From the perspective of disease prevention and health promotion, nationwide community-based health checkups began in 1982. People are encouraged to take health examinations when they reach the age of forty, regardless of their health status. As more people take the health examination, the interactions have increased between health-care providers and receivers.

Major sources of health-related information for adults come from mass media and interactions with health professionals in health checkup settings or in clinical settings. In spite of the efforts to improve health education, these interactions are not yet serving as opportunities for health-care receivers to learn about their health (Moriyama & Matsubara, 1991). As this type of interaction increases, complaints about the quality of communication pattern can be heard from both health-care providers and its receivers.

PROBLEMS TO BE SOLVED

The major disappointment comes from the one-sidedness of the communication at the setting. Typical communication is from health-care providers to receivers. Traditionally, the one-sided communication served to maintain the authority and efficiency of the health-care system. Most health-care providers used to take initiative in the communication by appearing to be the health authority. When providers asked questions of receivers, providers tended to seek essential and minimum information necessary for their decision making. When providers tried to persuade receivers to change their knowledge and behavior, providers tended to overwhelm receivers by giving one-sided appraisal or recommendations based on their authoritative knowledge as professionals.

Today, because of the increase of interactions in the community-based health checkup and health education settings, providers meet a greater variety of receivers with different needs and experiences. As they age, increasing number of receivers experience poor health. In 1989, of the population 65 years and over, 54.8% of males and 59.4% of females visit hospitals and/or clinics regularly due to some kind of illness or disease (Health and Welfare Statistics Association, 1989). How does this rapid aging of population and increase of disease affect the people's concept of health and illness or disease? Green (1985) indicates that significant emotional reactions accompany illness, and that each assesses the losses brought about by illness from a highly subjective viewpoint. Therefore, an increasing number of health-care receivers are supposed to have internalized their disease experiences and to have formed their own perspective of health and disease. To these "experienced" receivers, one-sided instruction from health-care providers does not have influence. Instead of merely listening to providers, receivers want to participate actively in the communication by asking questions and explaining contextual issues related to health and details of their health status.

The changing attitudes of receivers often make providers feel that their one-sided recommendations are not fully accepted by receivers. Providers have authoritative knowledge regarding health and illness, but they do not know the receivers' subjective viewpoint. Although most of providers want truly to help people in need, they have not adjusted to the changing needs of receivers. Instead of encouraging receivers to refer to their subjective viewpoints of health and illness, providers tend to discourage the receivers from actively participating in the communication. As a result, not only the health-care receivers but also providers often fail to get meaningful interactive feedback and, consequently, both parties get frustrated during such a communication pattern.

PROBLEM SOLVING STRATEGY

Change the Form of Communication

To change the communication from one-way to two-way is necessary for both health-care providers and receivers to deal with their frustration during the encounters. What strategy should be used to change the mode of communication? If both providers and receivers obtain meaningful feedback at the encounter, the communication

will truly be informative for both of them. In the U.S., substantial research results show that patients can be encouraged to ask questions (Robinson & Witfield, 1985; Greenfield, Kaplan & Ware, 1985). In Japan, however, there are few studies which have examined this issue. This phenomenon can be traced back to the Japanese culture and traditions, in which people tend to reserve their personal beliefs to themselves. Mere encouragement is not enough to increase interaction for Japanese people. The environment of communication should be changed so that each participant can express his or her health-related personal concerns more easily (Moriyama et al., 1990a). In this study, we developed methods to encourage interactions in the health-care settings, particularly to encourage health-care receivers to express their views.

Why Share Problems with People?

What can we do to help health-care receivers to express their health-related personal concerns more clearly and more meaningfully? Making information meaningful is a basic strategy both in education and health-care settings. One of the ways to make information meaningful is to understand the subject in a way that permits many other things to be related to it (Bruner, 1963). Bruner emphasized the importance of structure and concepts in teaching and learning. This conceptual approach was adopted to design health education curriculum in the U.S.(School Health Education Study, 1967). Today most of the health education curriculum in Japanese schools have already utilized Bruner's structural framework by taking into consideration children's conceptual development. The meaningfulness of health-related information is different, however, for the aged from that for children. Due to the fact that they have been out of school for a long time and have experienced aging, people will generally forget some of their knowledge learned in school. At the same time, through general experiences in daily life including natural cycle of wellness and sickness, each person internalizes his or her knowledge and finds new meanings. Meaningful learning refers not only to the acquisition of new knowledge but also to the discovery of new connections and associated meanings of the old knowledge.

In this study, we intended to emphasize the receiver's own conceptual framework and subjective viewpoint. How can we perceive the receiver's conceptual framework? The knowledge structure of experts or learners in learning a complex domain is known to form a network that is represented by a schema (Marshall, 1990). Schematic expression is an appropriate way to visualize the health-related knowledge structure of

providers or medical professionals for diagnostic purposes. However, it is premature to assume the same network structure for receivers' cognitive framework in the daily life (Moriyama et al., 1989a). We do not fully understand the conceptual framework of providers promoting health activity in the field (Moriyama & Matsubara, 1989b). In this research, we focused on learning the conceptual framework of both health-care providers and its receivers by involving them in the project to visualize health-related concerns. This line of thinking is consistent with Rogoff's (1990) cognitive apprenticeship, in which Rogoff argues, "problem solving emphasizes the active nature of thinking, rather than focusing on cognition as the passive possession of mental objects such as cognitions and percepts. People explore, solve problems, and remember rather than simply acquire memories, percepts, and skills.(p. 9)."

Why Express Feelings?

In typical health-related communications, the knowledge is primarily transferred, while the associated feelings are often not considered. Feelings are most often used when talking about emotional behavior, which belongs to the personal space of the individual. Most of the health-care providers are trained to suppress their own feelings and tend to avoid interacting with receivers' feelings. As a result, the health-related communications lack the exchange of feelings. However, expression of feelings plays an important role in our interpersonal relationships (Bennis et al. 1973). According to Lewis (1990), child's cognitive development plays a vital role in emotional life, whereas emotional life itself may be the basis for the development of thinking about ourselves. For the adults, feelings about their health play an important role in internalizing their health-related knowledge and in making information meaningful. In the following study, we had participants express their feelings by selecting visual symbols and graphics.

Why Graphics?

There are several reasons in adopting visual representations and symbols in the present research. One reason is to increase the communicability of health-related information. To communicate health-related information within a limited amount of time, information should be transferred quickly and varying degree of acceptability by aged people should be taken into consideration. Some health-related knowledge and concepts are difficult to express in simple terms. Visual representations are powerful

in communicating messages rapidly without relying heavily on the verbal expression (Sato, 1990; Tufte, 1990).

The second reason is that the visual representation is an efficient way to represent not only the fragments of information but also the relationships of information (Chambers et al., 1983). As the human eye-brain system is the most sophisticated information processor ever developed, we can put this system to good use by obtaining deep insight into the nature of information through visual and graphical displays. It is also well established in the literature that the visualizations of images facilitates learning (Harnisch, 1990; Harnisch & Zheng, 1991).

The third reason is the Japanese tradition of using visual symbols and cartoons in daily life. In Japan, not only children but adults as well enjoy cartoons. Visual representations and/or symbols are used on many occasions to express and to communicate information. Therefore, visual and symbolic representations of health-related keywords are considered to be acceptable and natural in the Japanese sociocultural tradition (Moriyama, 1990a, b).

INTERACTIVE DEVELOPMENT OF VISUAL METHODS

In order to assist communication in Japanese health-care settings, we chose a medium for health-care providers and receivers to visualize health-related feelings and concepts. Considering the multidimensionality of health, it is not realistic to visualize the whole dimension of "health" in a single diagram. In this paper, we first visualized each basic sensation and feeling accompanying an illness. We then visualized a wholistic concept of wellness from multiple numerical data. Finally, we extended our representations to visualize the multidimensionality of health.

First Level of Visualization: Individual Sensation and Feeling

Objectives

Complaining of one's unusual change of bodily sensation, function, and appearance is usually the first step of communication between health-care providers (physician) and receivers (patient) in health-care settings. The major difficulty in this communication is that as receivers express their concerns from subjective viewpoint, providers try to

understand and describe the complaints in experts' vocabulary. If the receiver's ability of verbal expression is impaired for some reason, the difficulty of communication becomes even more serious (Moriyama et al., 1991). We tried to visualize symptoms in order to promote communication.

Interactive Development of Symptomatic Symbols

Recently, an increasing number of colorful images have been used in various kinds of printed matters related to health and wellness. Most bodily sensations and feelings are, however, still expressed verbally and there are no systemic attempts to express them visually. In this study, figures corresponding to 30 general symptoms were drawn by medical students on the basis of free imagination and association of visualized ideas. Two college students, who were good at drawing, helped us to introduce new images related to symptoms. Three faculty members at Nagasaki University helped us to improve the understandability of the figures. Newly illustrated figures were inspected by a task force outside of the university, including two persons with hearing difficulties and an expert in manual sign language.

Insert Figure 1 here

Second Level of Visualization: Wholistic Concept of Wellness

Objective

Today, health is perceived as a matter of wellness--having a sense of vitality and overall well-being in life. The results of health checkup are expected to convey the concept of wellness. The concept of health and wellness is, however, sometimes difficult to share between providers and receivers. In the ongoing community-based health checkups in Japan, laboratory oriented numerals and their judgments (whether a given value lies within the normal range) are returned to each receiver as feedback. Medical experts are able to relate fragmented meanings of numerals, to compose a clinical entity and to make an appropriate clinical decision. Health-care receivers, however, have trouble in conceiving a coherent image of health and wellness from these numerals. In this study, we developed a visual way to convey the meaning of multiple indicators in health-care settings. We considered the following two points: (a) the graphics can

represent normality or abnormality of a given numerical result, and (b) the graphics can represent the wholesome image and/or feelings of wellness or disturbance, which is composed of multiple numerical indices.

Origin of Ideas

Chernoff's face graph (Chernoff, 1973) is of special interest since humans perceive the face as a gestalt and humans possess a special innate ability for visually processing faces (Gugel, 1985). In Chernoff's face, each point in k-dimensional space is represented by a cartoon of a face, whose features, such as length of nose and curvature of mouth, correspond to facial components.

Initial Trial of Computer Drawn Face

In order to draw a face graph using computers, we assigned each of the four basic health-related numerical values (blood hemoglobin, hematocrit, systolic blood pressure, and diastolic blood pressure) to corresponding facial features (right and left eyebrows, and upper and lower lips). We offered computer drawn face graphs to 22 nursing students at a community health center. Nursing students tried to use the face graph to give feedback of previous health checkup to health-care receivers. As for the receivers, they were interested in the facial representation, and preferred the face visual image to the numerical summary. However, after the initial excitement of the visual image, the computer drawn face did not promote interactions between students and receivers. Receivers just watched the face graph and listened to students. In contrast to the rich interactive phase observed during the mapping of cards on the paper, the face graph did not bring about much interaction for it had been completed by the computer and did not allow the users to engage in active interaction. Some students, however, tried to use face graph as cues toward interactive communication by adding some personal remarks with pencils.

Hand-Drawn Face Graph

We simplified the process of face drawing by adopting seven features that could be manipulated. For each of the facial features, we defined three positions (a, b, c), which represented 'pleasantness,' 'intermediate' and 'unpleasantness' respectively. Furthermore, these three positions corresponded to the following three ranges of numerals: 'normal,' 'borderline' and 'abnormal,' and the first version of hand drawn face graph was made.

Insert Figure 2 here

Third Level of Visualization: Multidimensionality of Health

Outline

Health today is seen as being multidimensional, encompassing many interrelated issues -- physical, emotional, intellectual, spiritual, and so on. Good health extends its meaning to include living in harmony with oneself and others. In daily life, people do not have much chance to think about the multidimensionality of their health. In this part of our research, we used small cards to express health-related keywords and a two-dimensional framework to arrange these cards. By doing so, we intended to visualize the multidimensionality of health from a subjective perspective.

Origin of Idea

The authors utilized the following two ideas and developed a new framework for mapping.

KJ-method: In Japan, the most well known method to organize ideas with paper and pencil is the KJ-method (Kawakida, 1986). In this method, a participant writes down each of his fragmented ideas on a label and tries to make some meaningful clusters of labels on a large sheet of paper. Since its development, this method has been used widely in Japan as a way to stimulate thinking and organize ideas.

Chromatography: Chromatography is an analytical technique of chemistry, which separates the components of a mixture by differential migration. Among the chromatographic methods, paper chromatography is characterized by the choice of heterogeneous phases of the liquid/liquid type and also by the flatbed arrangement (Macek, 1975). The followings are the procedures of two-dimensional chromatography.

Step 1: Prepare the sample (a mixture of components), a square piece of paper, and two solvent systems (mixture of solvents).

Step 2: Put the sample in the form of a spot near one corner of the paper.

Step 3: Apply the first solvent system at one side of the paper. The solvent system flows to one direction. As a result of this first development, the sample is separated into components which are apparent on a line.

Step 4: Apply the second mobile system at the right angle of the paper. The second development is carried out in the direction at a right angle to the first one. The linear arrangement of components changes into two-dimensional arrangements.

Insert Figure 3 here

Toward a New Framework; Two-Dimensional Mapping

Because of its familiarity and popularity among Japanese people, 'paper and pencil' way of KJ-method seems to be an adaptable technique to visualize personal viewpoints. This method has, however, many limitations to be applied at health care and service settings. The major purpose of the KJ-method is to find some meaningful solutions to a complicated problem. The labels used in the first step can sometimes exceed a hundred with the typical procedures of this method taking from a few hours to a few days. This method requires experience, and the beginners need to have intensive training to use this method. We incorporated two-axis arrangement of chromatography on a sheet of paper, and guided the direction of moving and arranging cards as follows:

Step 1: Identify keyword cards.

Step 2: Identify two axes (vertical and horizontal) which constitute a two-dimensional frame for mapping.

Step 3: Arrange cards along the horizontal axis.

Step 4: Arrange cards along the vertical axis.

Insert Figure 4 here

FURTHER DEVELOPMENTS AND TRIANGULATION OF METHODS IN A COMMUNITY HEALTH ACTIVITY

After we developed prototypes for visuallization, we were required to specify the details for each framework, and developed new interactive uses of these methods. We were also required to conceive the detalis of people's needs in the field. In the process of problem solving, these two requirments were inseparably related. In the previous section, we already involved people around us to develop prototypes of visualization. In

this section, we extended our strategy to involve people in the process of problem solving, and we intended to learn more about the people's approach to express health-related concerns and to interact with other people. Through our daily activities of teaching and research at Nagasaki University and with the community-based health promotion in Nagasaki prefecture, we shared our ideas with health-care providers and receivers. Particular groups of health-care providers (community health nurses and/or dietitians) and volunteer helpers were interested in different portion of these studies. Through diversified experiences in the field, we obtained practical and detailed suggestions which enriched and improved each method. We generalized these suggestions, and elicited common rules for the improvement of the methods.

Symptomatic Symbols

Improvement of Symbols by Inquiry

We publicized 30 initial symbols to community health interest groups. At first, a small group of hearing impaired people and their voluntary helpers were interested, and extended to the following two organizations: Nagasaki Prefectural Association for the Welfare of the Deaf and Dumb, and Nagasaki Branch of the Japanese Study Group of Sign Language Problems. These two organizations helped us to improve each of the symbols by offering situations in which to observe people's comprehension of symbols at both group-based and case-based settings.

Group-based inquiry: Symbols were inspected and the meaning of each symbol was guessed by three groups of people: (a) 7 hearing impaired people, (b) 20 specialists of sign language with normal hearing ability, and (c) 29 community health nursing students with normal hearing ability. On the average, these three groups guessed the meaning of 16.6, 25.5 and 28.0 out of 30 figures, respectively. For those figures which were misunderstood by hearing impaired people, the details of the figures were corrected to reduce the misunderstanding.

Case-based inquiry: In the group-based inquiry, hearing impaired people showed lowest level of understanding figures in comparison to other two groups of people with normal hearing ability. In order to find the reason of this low understandability of hearing impaired people, we interviewed three of them with the assistance of a sign language specialist, and asked about their perception of the symbols. From this case-based inquiry, the following three points were revealed as reasons for misunderstanding:

(a) concentration on details of figures and misunderstanding of the whole message expressed by the figure, (b) lack of sociocultural experience to understand the specific information accompanying the figure, and (c) confusion of hand position and movement accompanying symptoms with sign languages. These points were taken into consideration in improving each of the figures.

Insert Figure 5 here

Quest for Communicative Needs in Health-Care Settings

To understand the possible use of visual symbols in health-care settings, we administered the questionnaires to 37 hearing-impaired people at a conference in Nagasaki City in 1989. Of the 37 participants, 80% had experienced some communication difficulties during a hospital visitation. When hospital visiting was decomposed into four components (Table 1), highest percentage of people (62%) experienced difficulty in communicating with the physician.

Table 1. Hospital Visitation Phase and Percentage Experiencing Difficulty (n=37)

Hospital visit Phase	Percentage experiencing difficulty in communication
1. Before reaching the hospital	28
2. During acceptance	40
3. During encounter with physician	62
4. During payment and acceptance of pharmacy prescription	28

We, then, interviewed five participants about the details of the communication difficulties. Difficulties in understanding the physician's questions and difficulties in expressing one's own complaints were revealed as the major problem in the communication. In order to use visual symbols as an aid in these settings, we needed to represent contextual relationship of the symbols. From further discussions with hearing-impaired people and their helpers, three principles were suggested to enhance the meaning of visual symbols:

1. Visualize a process of illness as shifts from normal to abnormal status,
2. Present paired visual symptoms of opposite meanings to enhance meanings,

3. Make clusters of visual symbols based on the basic needs of daily activities, such as eating and digestion, defecation and urination, physical exercise, etc.

Insert Figure 6 here

Rules Suggested to Visualize and Improve Symptomatic Symbols

During the process of developing and increasing the comprehensibility of figures by trial and error basis, many practical suggestions were obtained from people working with us. Suggestions were classified into the following six points:

1. Use simple lines,
2. Use facial expression to represent the general feeling and sensation of symptoms,
3. Try to discriminate the generality and/or locality of symptom,
4. Add situations to enhance the meaning,
5. Illustrate coping behaviors to enhance meaning, and
6. Express time and quantitative factors of the symptom.

Face Graph

As a result of good acceptability of prototype by the community health personnel in the preliminary study, we publicized the possible use of hand-drawn face graph as an aid in communication at several conferences of community health interest groups. Some of them independently adopted and/or revised the prototype according to their own needs, and developed the unique communicative use of a face graph. In the next section we present two specific cases where the face graph was implemented.

Fukuoka City Case

In the South Ward Public Health Center of Fukuoka City, the staff noticed the importance of the new setting for discussing health education, in which people can learn the meaning of their health status within a social context. Before the introduction of face graph, however, the staff did not have a chance to materialize their ideas as a community health project. In September 1989, the director of the center introduced face graph, and during the next three months, five community health nurses used the face graph approach with a total of 145 elderly people at five health counseling and education sessions in the community. The nurses adopted the prototype of the face graph with minimum revisions, and found the best situational setting to apply face graph. At each

session, the nurses tested the appropriateness of several situational settings, such as sequence of instruction and counseling, timing in offering face graph, seat arrangements, etc. As preferable responses were obtained from participants of this initial trial, nurses revised the face graph and continued their trial throughout the following year. The hand-drawn face graph was found to enhance the interactive communication of people concerning one's unique health status. This communication enabled people to have improved understanding regarding their unique health status.

Insert Figure 7 here

Town of Fukushima Case

In the Town of Fukushima, elderly people's difficulty in understanding the numerical results of health checkups had been a major concern for community health nurses. If an abnormality was detected for a person by the health checkup, the person was offered two options to receive their results; by taking a counseling session or by receiving the mailed result.

Table 2. Percent consulting physician when informed of medical status by mail or counseling attendant.

Informed by	Year	N.	% consulted physician
Mail	1987-88	39	59
	1989	26	65
Counseling	1987-88	109	74
	1989#	55	98

Face graph was used.

On these occasions, people were recommended to consult a local physician for further checkup or treatments. To stimulate people's interests in their own health-status and health promotion, community health nurses introduced hand-drawn face graph into counseling session after health checkup. Before the introduction of face graph (1987-88), the percentage of people consulting physician were similar for both mail recipients and those counseling attendants. After the face graph was introduced in 1989, the number increased for counseling attendants. The results point toward the

effectiveness of the hand-drawn face graph as a tool to activate the people's interests toward their own health status.

Insert Figure 8 here

Rules Suggested to Construct the Face as a Representation of Wellness

To avoid the misunderstanding of message expressed in a face, the representation of health-related numerals using facial expression should be easy to interpret for both providers and receivers. Screening of hypertensive vascular disease has been one of the major concerns of health-care providers in Japan. In both the Town of Fukushima and Fukuoka City, groups of community health nurses assigned blood pressure to the curvature of lips. From our interviews with both groups, nurses attributed the reason of this assignment to the importance of lip position in recognizing the facial expression in daily life. The Town of Fukushima is more complicated in comparison to the rather simplified facial expression of Fukuoka City. In this face graph, eye and related features play important roles in the visibility of the face. Three possibilities of disease, such as anemia, liver dysfunction, and diabetes, are assigned to eye brows, eye balls, and tears, respectively. Based on our interviews, community health nurses recognized the people's high emotional reactions when they were diagnosed as diabetic. Therefore, health-care provider's perception of the importance of disease and health-care receivers' emotional reactions to the disease was observed to contribute to the design of face graph in each community setting.

Two-Dimensional Mapping

Two-dimensional mapping was offered as the third level of visualization. In order for people to use this framework in the field, selection of meaningful keywords and axes needs to be done. The use of two-dimensional framework was described and offered to community health interest groups as an alternative technique.

Town of Nagayo Case

On occasion of community-based health promotion class for housewives in the Town of Nagayo, Nagasaki Prefecture, Japan, a community health interest group adopted our idea of mapping. This task force consisted of three community health nurses and one dietitian. They were interested in the framework and worked with us to select topics and

keywords. We adopted 'eating habits' as the theme of mapping. We selected major Japanese food items as keywords such as rice, miso soup, pickles, nishime, noodles, bread, milk, salad, meat, and fish. From the view of healthy eating habits for the elderly people, "consumption" and "contribution to health" were the two major concerns for the task force. Therefore, we defined "eating frequency" as the label of horizontal axis, and "importance to ones own health" as the label for the vertical axis.

Six housewives participated in the health promotion class. This class was held once a week for seven weeks, and at the first and last class, participants mapped their concerns by using this two-dimensional framework. In a traditional community-based nourishment session, dietitians would ask for details about the content and amount of the food intake. Health-care receivers would simply listen to and answer the dietitian's questions. However, after the introduction of mapping, one-sided communication was replaced by interactive communication.

A sample of interaction;

[Dietitian] According to your mapping, you take often milk. You also think milk is very important to your health. Why do you think so ? Because, in our culture, milk is a kind of westernized food item, and generally, the elderly people used to take not much milk in comparison to younger generation.

[Receiver B] Last year, my family doctor recommended me to drink much milk. Since then, I always try to drink milk. Recently, I came to drink milk often.

[Dietitian] Then, why did you put miso soup and pickles in the lower left corner of coordinates? As you know, pickles and miso soup have been traditionally the staple food items in our culture.

[Receiver B] I have had high blood pressure for these ten years. A dietitian recommended that I avoid foods with higher salt contents. Since then, I am avoiding pickles and miso soups.

(After the mapping session was over, the members of task force examined maps of participants and discussed the health-related profiles of participants. Each of maps helped the task force to share the image of eating habits for an individual participant.)

[Dietitian] These maps represent images of eating habits of six subjects who attended the health promotion class today. What do you think of these images?

[Nurse] I am interested in these maps. It seems that these maps reflect individuality.

[Dietitian] I am worrying about the food image of subject B. Her food images seems to be deviated enormously from the general characteristics of other people. Do you have any clue to understand this pattern?

[Nurse] This person has the past history of high blood pressure and is a diabetic. This person keeps from salinity to the blood pressure and is reducing the intake of the carbohydrate to the diabetic. However, this person may be drinking too much milk.

Insert Figure 9 here

Rules Suggested for the Two-Dimensional Framework

To represent the relationship among keywords in the two-dimensional framework, what kind of variables should we assign to the horizontal and vertical axes? In mapping keywords, we asked respondents to concentrate first on the horizontal axis and then on the vertical axis. The sequential shifting of attention from horizontal to vertical axis should correspond to the people's natural sequential process to recognize and solve health-related problems; such as description of problem, recognition and feeling of problem, and solving of problem. The following arrangements of cards correspond to these phases:

Arrangement 1. Rank keywords according to the standing of an objective value dimension,

Arrangement 2. Rank keywords according to the standing of a subjective value or feeling dimension,

Arrangement 3. Rank keywords according to the necessity of problem solving.

If we organize these arrangements to selections of axes, the resulting possible combinations of horizontal and vertical axes are as follows:

1. Objective value vs. subjective value,
2. Objective value vs. necessity of problem solving,
3. Subjective value vs. necessity of problem solving, etc.

ENRICHMENT AND TRIANGULATION OF METHODS IN DIFFERENT CULTURAL SETTINGS

In the previous sections of this paper we described our process of development and triangulation in Japan. These three methods were found to be useful in several types of community-based health promotion activities. In order to define the possibility and limitation of these methods, it is necessary to triangulate these methods in other sociocultural settings. As a result of visiting and working in the U.S., we began to triangulate these methods in the U.S. At the University of Illinois at Urbana-Champaign, we publicized the use of two-dimensional framework at several seminars and invited participants to join our project. Several projects are currently underway which use these methods for examining health-related issues.

Symptomatic Symbols

In Figure 1 are shown the symptomatic symbols which were developed with the assistance of hearing-impaired people. These symbols represent common general symptoms. To apply these symbols in health-care settings in the U.S., we reconsidered each of these symbols and overall framework to represent them. We formed a task force which include two faculty members of the University, one student and one physician working for his clinic in the city of Urbana. Based on our task force discussions, we chose headache as one of the most common health problems in the U.S., and began to visualize characteristics of headaches. As a framework to represent various types of headache images, we adopted physician's viewpoint. Each physician is supposed to have his own sequential structure of inquiry. In Figure 10, we visualize the sequential structure for a physician's interview.

Insert Figure 10 here

Two-Dimensional Mapping

With cooperation of a colleague, we developed a two-dimensional framework for measuring two components of ones eating habits. From a survey to 96 undergraduate students in a contemporary health education class at a midwestern university, we collected data about their eating habits. The following were the top twelve reported food

items consumed by students; milk, bread, chicken, fruits, cereal, vegetables, pasta & spaghetti, salad, pizza, juice, apples, ice cream. These data were used as key food elements in a two-dimensional framework activity, which was used in the later interactive sessions.

Insert Figure 11 here

One of the most important issues for both faculties and students in the usual lecture oriented classroom setting is selection of topics taught in an health introductory course. We extended our application of two-dimensional mapping to the curriculum topics by selecting the following thirteen lecture topics as keywords; exercise, diet/nutrition, weight control, smoking, alcohol use, substance abuse, sexually transmitted diseases, cancer, cardiovascular health, stress management, self care, and contraception.

Insert Figure 12 here

DISCUSSION

The Framework of This Research

This research represents a development effort versus a fixed framework of hypothesis testing. This research is based in a stream of community-based health promotion activities. At the beginning, we did not necessarily expect such continuous nature of problem solving. However, because of the urgency of the initial problem, "growing difficulty of communication in the health-care settings", and the enthusiasm of people who contributed to our study, the authors were involved in this line of inquiry. In this research, the two important themes, "problem solving" and "problem sharing", are inseparably related to each other.

Problem Sharing as Problem Solving: In this paper, the initial problem is "How to assist and promote interactive communication between health-care providers and its receivers in the health-care settings?." If we had some theory-based hypotheses to solve this problem at the initiation of this study, we would have proceeded to test them by setting experimental and control groups, specifying parameters to be compared, and so on. However, we did not have such theory-based hypotheses and/or framework to

describe the nature of cognition of health and wellness of community people. Therefore, instead of offering a theory-based experimental framework, we offered a series of incremental investigations, which were developed in actual settings. We encouraged people to develop, use and triangulate these frameworks with us. Through this process of involving people in this research, we incorporated people's viewpoints in visualizing health and wellness.

Problem Solving as Problem Sharing: In this research, it is critically important to share and learn the people's viewpoints to stimulate interactive communication. Although we can collect data from people by surveys, it is difficult to learn about people's creative viewpoints with this approach. People usually respond passively to data collection. In this study, by setting the interactive development of visualization as the research objective, we could share in the process of problem solving with people. With the advancement of our studies, some health-related images are actually visualized, and the clarity of results thus enhanced the people's active participation.

From our understanding of the inseparable interaction between "problem solving" and "problem sharing", we observed people's viewpoints in various aspects; such as improvements in the visual framework, develop tentative rules to create visual framework, and develop the communicative use of framework.

Development of Methods in Different Settings

When we publicized each of graphical frameworks in the second phase of problem solving, some specific interest-groups of people were interested in this framework. With visual symptomatic symbols members of two supportive organizations for hearing-impaired people helped our project continuously and enthusiastically. By sharing the process of development and improvement of visual images, we learned about the health-care receiver's cognitive nature of symptoms and their communicative difficulties from the viewpoints of hearing-impaired people. In the case of hand-drawn face graphs, most enthusiastic responses were obtained from health-care providers, especially community health nurses working in the field. In each group of the City of Fukuoka and the Town of Fukushima, nurses adopted our prototype of hand-drawn face graph, reformed it independently, and applied in the field in 1989. According to this first year's experience, they revised it and tried again in 1990. Two-dimensional mapping techniques were valued by trying health-care providers , especially dietitian and community health nurse. Each group was interested in its application in the

community-based class for health promotion. In this setting, both health-care providers and its receivers shared their viewpoints related to eating habits.

In the third phase, we extended our framework to another culture in the U.S. In this new setting, visual symbols were used to visualize the concept of headache from a physician's viewpoint. Two-dimensional mapping was first used to visualize the concept of eating habits of college students, and was further applied to visualize subject matter topics related to curriculum coverage and importance of each topic.

Our results from the second and the third phase of problem solving indicate that each of our visual frameworks revealed and encouraged the individuals attempt to communicate interactively in each settings.

Methods and Its Meanings

In this study, we developed three methods to visualize health-related concepts at three levels ranging from basic sensation and feeling to multidimensionality images of health. Although we have some guidelines to follow for face graph and two-dimensional mapping, the developed methods are not the mere improvements of its origins. Symptomatic symbols are an original idea. We developed our initial thirty symbols by free imagination and continuous triangulation with health professionals.

As already described, this research proceeds as a chain of inquiry. We used our preliminary result of triangulation as a clue to the further improvement of methods. This study does not contain an orthodox framework of quantitative evaluation. However, this study contains various types of informal triangulations offered by various types of people in the field. The results of this study point toward the effectiveness of visualization as a way to promote productive interactive relationships in community-based health promotion activities.

As we directed our research efforts to find practical solutions of communication difficulties in the field, we have not yet understood fully the cognitive nature of people toward health and wellness. However, from the case-based observation of people's contribution of method development and its use, we can suggest some nature of cognition descriptively. Concerning symptomatic symbols, we at first developed prototypes in Japan under the cooperation of hearing-impaired people from the viewpoint of heath care receivers, and we extended its application to visualize the concept of headache.

The network nature of semantic connection of medical experts' knowledge is well established in the literature. In these knowledge structures, feeling is not represented.

According to the case based observation in this study, both the providers and receivers accepted the result of two-dimensional mapping as stimulating and enlightening feedback. This indicates that the simultaneous representation of keywords along subjective dimensional axes fits well with the people's cognitive nature of health and wellness.

Paper and Pencil Method versus Computer Assisted Method

In this study, we adopted paper and pencil arrangements because of its simplicity and practicality along with its interactive use in community-based settings. However, with the use of computer technology, we can apply these mappings to more complex problems. In the case of visual symbols, we adopted flip charts to represent our visual symbols. If we put this information into hypertext framework, we can represent same visual images differently according to the needs of users, from viewpoints of both health-care providers and receivers. In the case of visualization of multidimensionality of health, we adopted two-dimensional framework. However, considering the multidimensionality of feelings, we can extend our mapping to three or higher dimensions with the use of visual displays.

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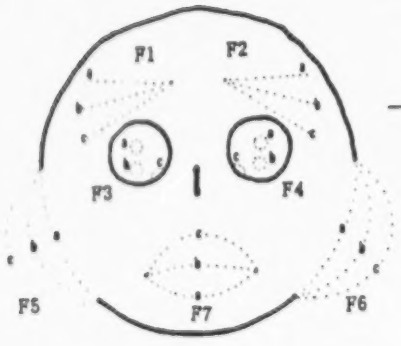
Figure 1. First Thirty Symptoms Visualized



Positions of features	Pleasantness-unpleasantness scale	Normal-abnormal scale
a	Pleasant	Normal
b	Intermediate	Borderline
c	Unpleasant	Abnormal

Figure 2. First Version of Hand-Drawn Face Graph

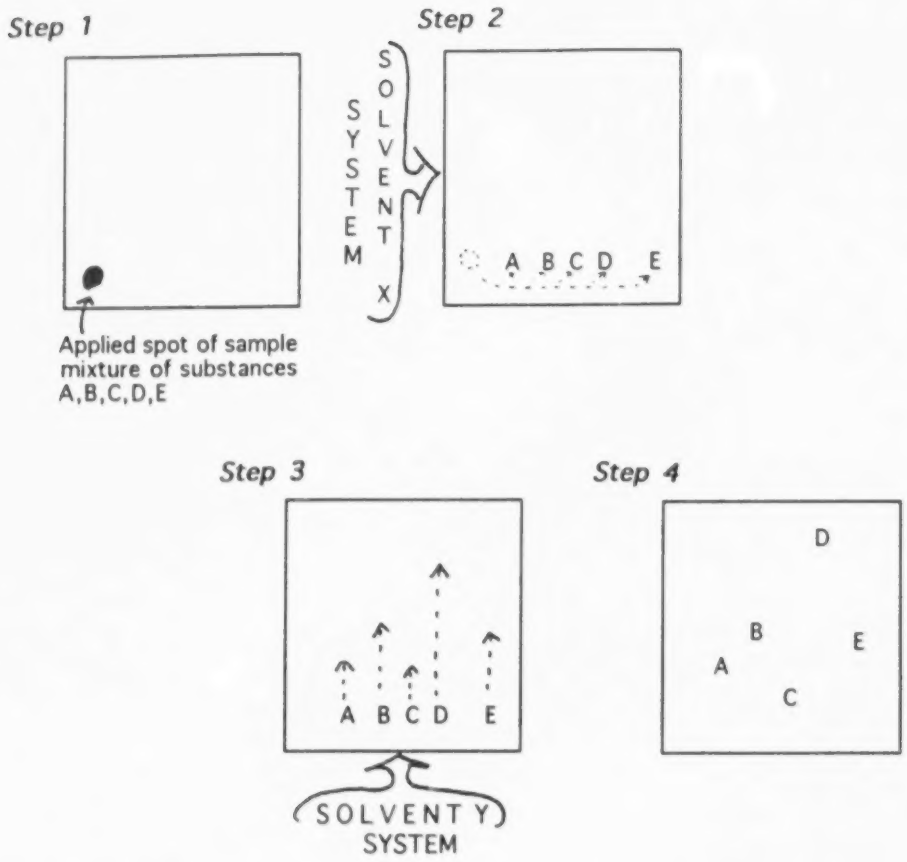


Figure 3. Procedures of Two-Dimensional Chromatography

Figure 4. Procedures of Two-Dimensional Mapping

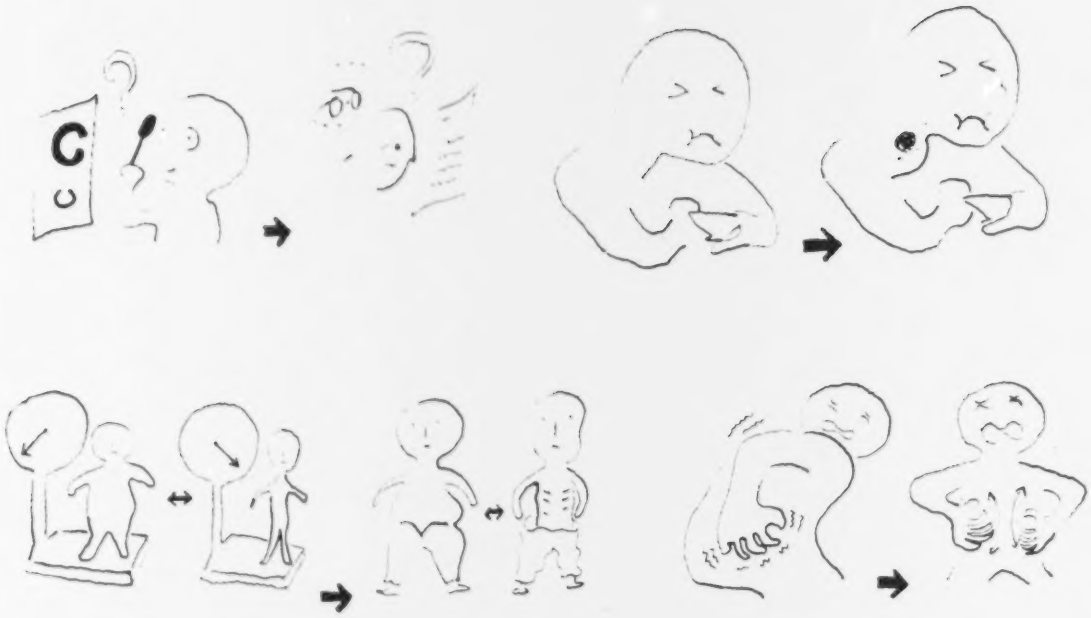


Figure 5. Examples of Improvement of Figures

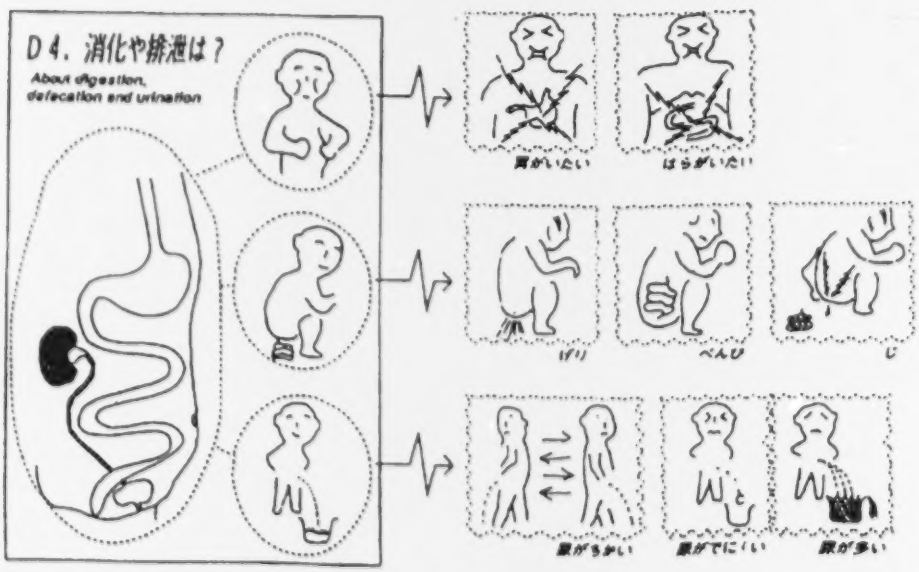


Figure 6. An Example of Representing Visual Symbols Considering Contextual Relationships

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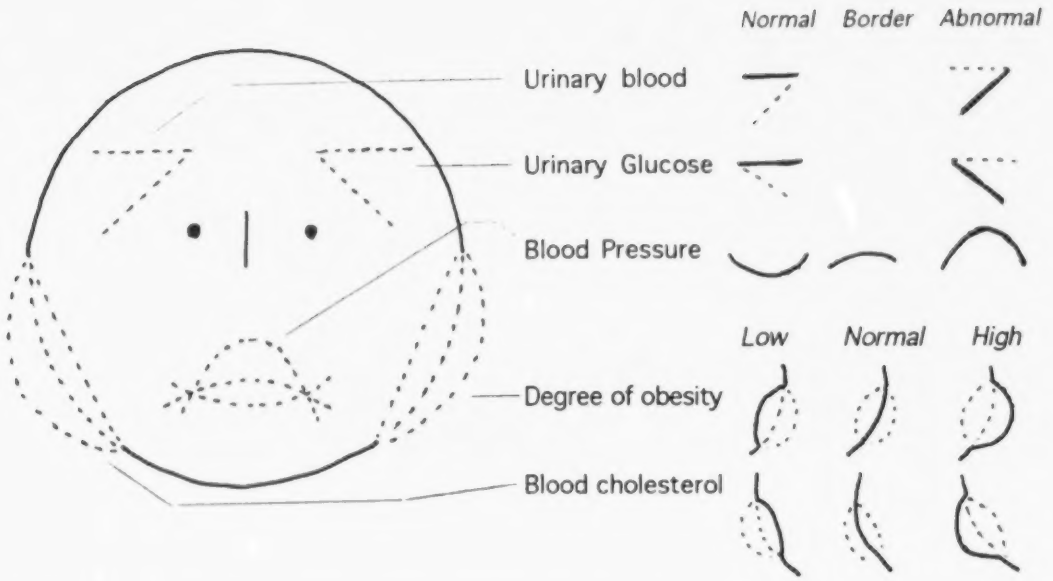

Figure 7. Hand-Drawn Face Graph used in Fukuoka City

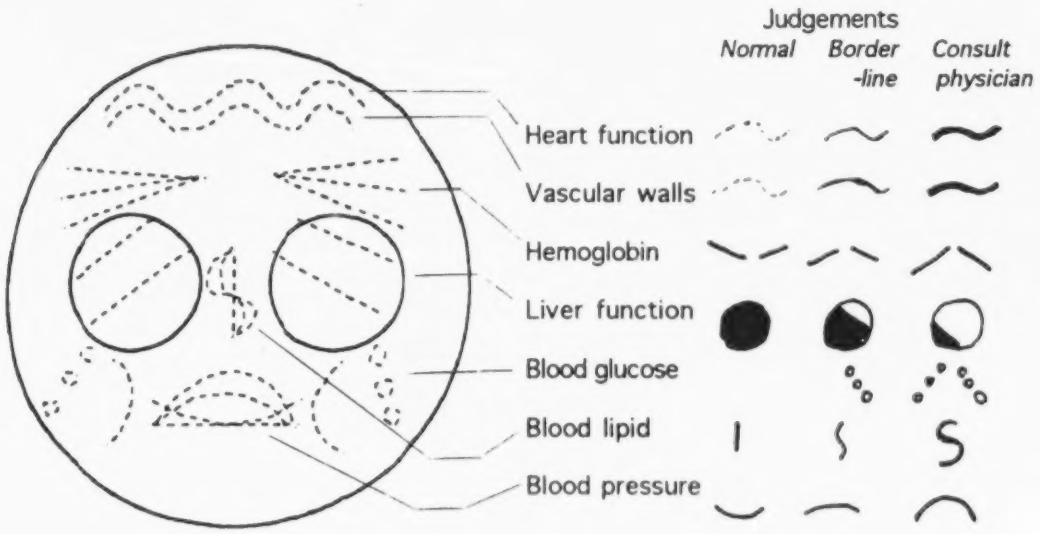

Figure 8. Hand-Drawn Face graph Used in the Town of Fukushima

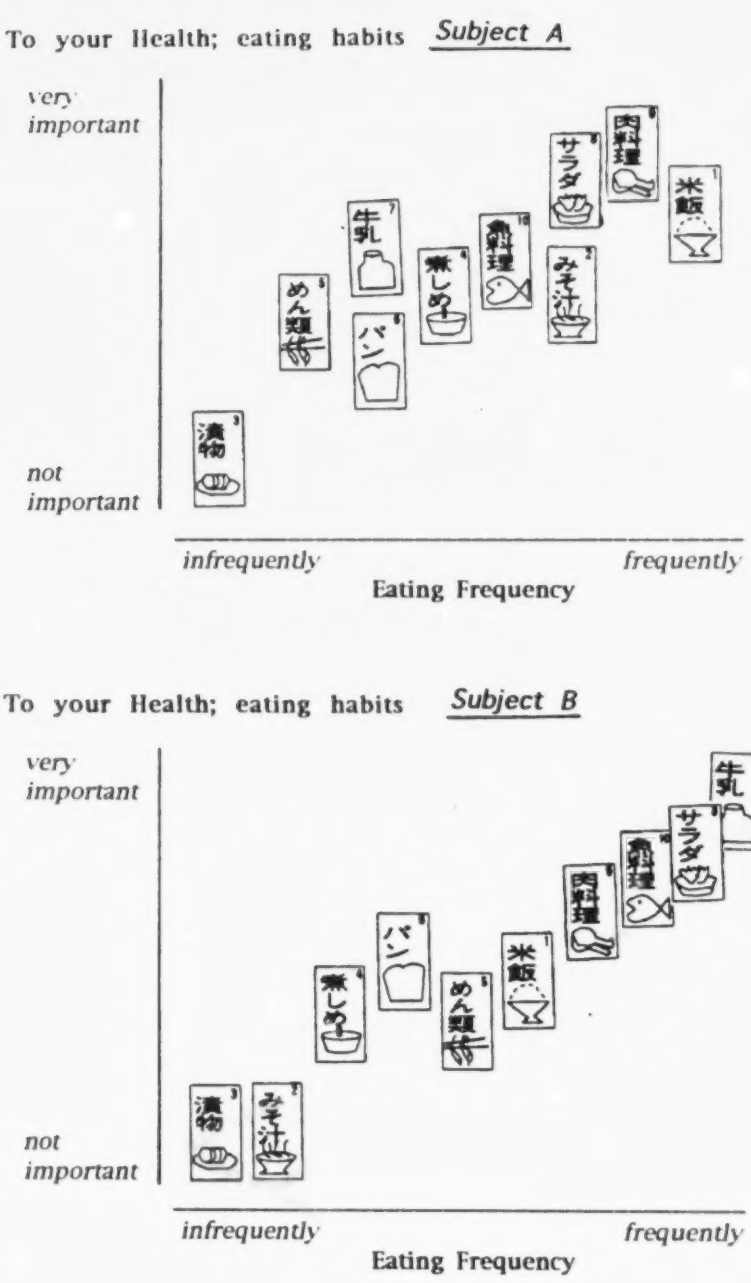

Figure 9. Two-Dimensional Mapping of Eating Habits, Two Examples

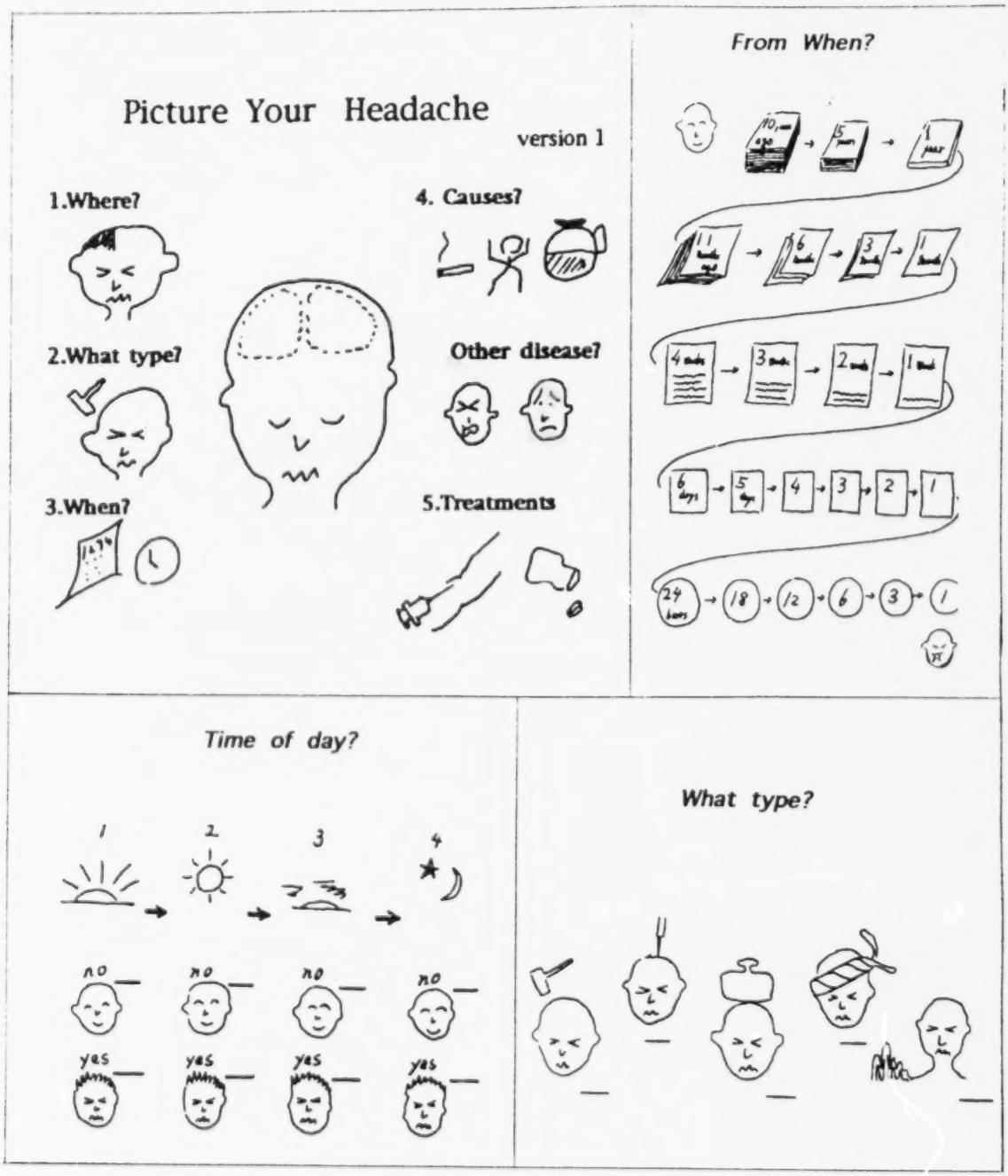

Figure 10. Picture Your Headache: First Two Pages of Flip Chart

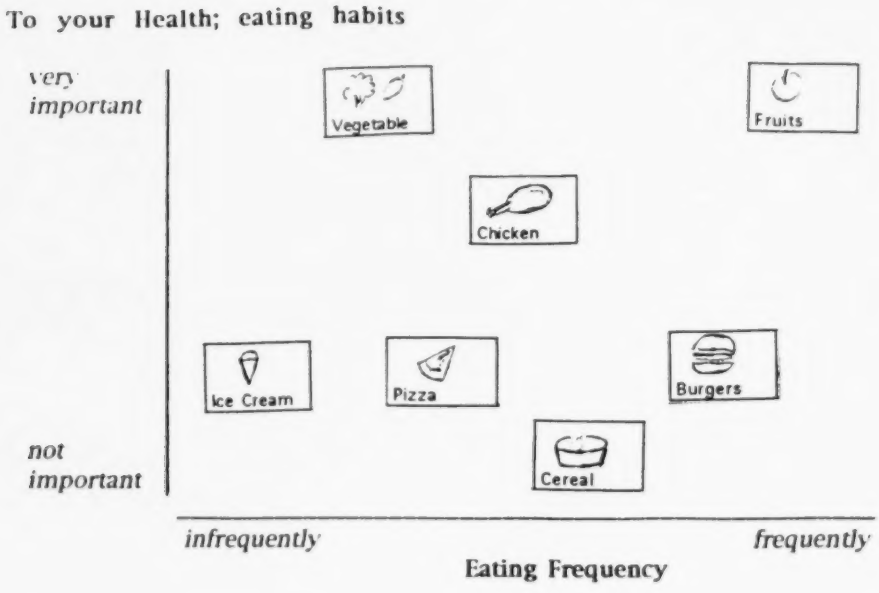

Figure 11. Two-Dimensional Mapping of Eating Habits: An Example in the U.S.

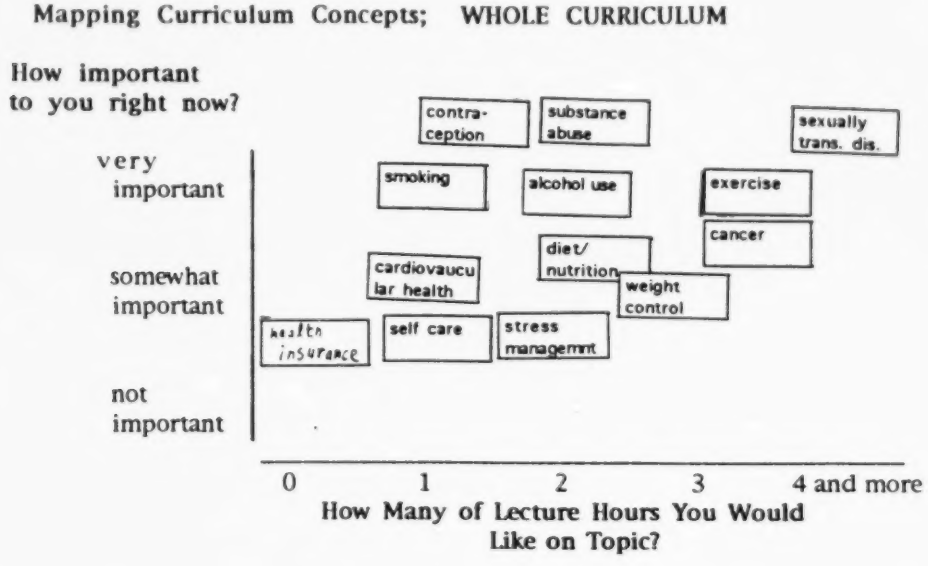

Figure 12. Two-Dimensional Mapping of Curriculum Concepts: An Example in the U.S.